The NEW YORK CONTINENTAL JEWELL FILTRATION COMPANY

GENERAL OFFICES
15 Broad Street
NEW YORK

INTRODUCTORY

General Notes

Manufacturing

OUR factory is the largest if not the only one in the world exclusively devoted to the manufacture of filters. It is equipped with all the latest improved machinery and with many special machines designed especially for our work. None but skilled workmen are employed, many of whom have been in our employ for several years.

Drafting

The drafting and designing department is most complete. Drawings and preliminary sketches showing the general arrangement will be made to accompany propositions when desired, provided we receive the necessary data concerning the proposed location, etc.

Complete working plans of large gravity and pressure filter plants are made after acceptance of proposition and submitted for approval. For this purpose our engineers generally visit the works to obtain measurements and full information in detail.

Laboratory

We have a skilled chemist in charge of our laboratory, where all of our own chemical, microscopic and bacteriological tests of waters are made. It has been our custom for years to make complete analyses and practical tests of all waters, unless we are perfectly familiar with them, to determine the best and most economical methods of purification. Parties wishing complete reports on the purification of their water supplies should write for instruction pamphlet before sending sample.

Patent Protection

The New York Continental Jewell Filters and auxiliary appliances are the result of over thirty years' experience and practical work in the purification of waters, during which time nearly 400 patents have been issued thereon, in this and foreign countries, and our customers are amply protected in their use of any apparatus or appliance purchased of us.

Prices

Owing to the various conditions attending the location and erection of our filters, especially for city water works, paper mills, sugar refineries and other large industries, where generally two or more of them are connected in a battery, the arrangement of each plant must be separately designed. We are, therefore, prepared to make an estimate of cost only when we have become fully conversant with the circumstances bearing directly on each individual case and we have, therefore, omitted all figures of cost in this issue. Our prices are most reasonable, and unquestionably the lowest for the highest possible standard of workmanship, efficiency and durability.

We guarantee to replace at our own expense any parts proving defective due to inferior workmanship or material, if called to our attention within one year from date of installation.

The Following Information Is Requested When Inquiring About Filters

1. What is the source of supply—lake, stream, deep or shallow well?

2. Is the water turbid, and to what extent?

3. If you have analyses, send copies. Information as to alkalinity especially desired.

4. To what use is the filtered water to be put?

5. Do you desire gravity or pressure filters?

6. What available horse power have you? Water power? Steam? Electricity?

7. State number and capacities of pumping machinery, and if electrical state phase and character.

8. What is the maximum pressure on present pipe system?

9. Do you pump direct, or to standpipe or reservoir? Give elevations, in feet.

10. State maximum amount of water used per hour.

11. What working pressure would filter shell be required to stand?

12. Give dimensions and sketch of available space for proposed filters.

13. What is the relative elevation of high-water and pump-room floor and proposed site of filters?

14. Give character and bearing value of soil if excavation is necessary.

15. Send data covering sewer conditions; elevation of present sewer, if any.

Gravity Filters

The following brief description of the several TYPES of GRAVITY FILTERS explains the particular usefulness of the machine to comply with certain local conditions, and also accounts for the difference in the cost of the several types of filters having the same diameter.

Any Gravity Filter is an open tank in which the sand bed is contained arranged above a strainer system and the water to be purified passes through the sand bed by gravity, usually after preliminary sedimentation, into a clear water well frequently located beneath the filter. These filters may be constructed of concrete, steel or wood and it can be said that the use of concrete is increasing in this connection. There is, however, a considerable difference in the equipment of the filter according to the type.

THE NEW YORK SECTIONAL WASH GRAVITY FILTER. This filter has as its distinguishing feature the "Sectional" arrangement of the strainer system whereby the water used in washing is diverted through one of the valves into one of the several sections of the strainer system so that the incoming wash water may act upon one section at a time with greater velocity than would be the case where the entire strainer system was affected by the same amount of water. Experience has shown that with many waters this method of washing is as satisfactory as the more direct attrition furnished by the use of rakes or air, and the construction being simpler is less costly and is especially adapted to locations where no power is available except the water under pressure.

THE CONTINENTAL GRAVITY FILTER. This filter has the strainer system of the well-known Little Falls or "Williamson" type, trapped so as to admit of air under pressure within the header and manifold pipes during washing. The air being furnished through a blower or compressor is forced upward through the strainer system and perforates the filter bed equidistantly and under equal pressure, affording openings through the bed into which the reversed stream of wash water follows, reaching all portions of the filter bed evenly, removing the impurities lodged upon the bed and within it, flushing the impurities to the sewer opening and leaving the filter bed clean again for the purpose of purifying water.

The necessity of a blower or compressor in connection with this method limits its use, so far as economy is concerned, to cases where a number of units are necessary, as the first cost of the blower increases the cost of one unit out of proportion.

No method of air or water distribution in filtration has given the perfect distribution so essential to the washing of the filter, as the Williamson patented trapped air wash method employed in this filter.

THE MODIFIED JEWELL FILTER. This filter is constructed with a single tank and wash water gutters are attached to the side of the tank, doing away with the necessity of having two tanks, one within the other, as in the Jewell Filter. It is provided with the iron rakes to assist in the breaking up of the sand bed during the washing operation. This filter can be furnished at a less cost than the Jewell Gravity Filter hereinafter described and in many cases can be used to do the same work.

THE JEWELL GRAVITY FILTER. This filter is equipped with the agitator or reversible rake used in "breaking" up the bed during the washing period. While the reversed stream of water is forced upward through the strainer system, lifting and permeating the filter bed of sand and gravel, the rakes are revolved through the sand bed at the same time, thus subjecting the bed to the double action of the agitator and the wash water, thoroughly cleansing the bed and flushing out the impurities to the sewer. In the Jewell Gravity Filter the double tank construction is adhered to, the space between the outer and inner tank being utilized as an annular trough to carry away the wash water in the manner of a weir. While filtering, this same space is employed to distribute the influent water evenly over the filter bed with the least disturbance possible.

THE HIGH-TYPE JEWELL GRAVITY FILTER. This filter is superimposed above a settling tank upon the same floor space and is very convenient and efficient for moderately turbid waters at low cost of installation.

THE LOW-TYPE JEWELL FILTER. This filter is arranged generally in conjunction with independent sedimentation tanks.

All of the above described types of filters are controlled by controllers of either the "Weston" or "Venturi" type, as may be selected, arranged with the "down-draft" extension into the clear well, enabling the plant to increase its capacity automatically during any abnormal condition such as would be caused by a fire of unusual size and duration.

All of the above described filters are operated by "Negative Head" and are fully covered by patents No. 11,672, June 28, 1898; 546,738, September 24, 1895, and 644,137, February 27, 1900, describing the down-draft principle now employed in practically all modern filtration work.

THE WARREN GRAVITY FILTER. This filter is especially adapted to conditions where very little head is obtainable for operation. In connection with a weir tank it operates under a head as low as 20", the weir tank furnishing the wash water for the cleansing of the filter.

"Pressure Filters"

These are described and shown in separate catalog

Send for our "Pressure Filter" catalog

Coagulation

Clear Water

Showing Coagulation

During Subsidence

Coagulation, Sedimentation and Filtration

Coagulation is so essentially a feature of mechanical filtration that a thorough understanding of the process is important. In fact, it is a distinctive part of mechanical filtration. It may be said where sedimentation is accomplished upon a muddy water by four days' settlement, that the same result can be accomplished by coagulation in four hours. Roughly considered, coagulation is produced by the introduction into the raw water of a soluble chemical salt, capable of decomposing and becoming insoluble when brought into contact with certain constituents of the water itself. *The result is the formation of an insoluble gelatinous coagulum of great bulk and relatively greater specific gravity than is possessed by the impurities contained in the water. This coagulum, gradually aggregating together, precipitates or subsides throughout the water, enveloping and dragging down such suspended matter and color as it comes into contact with, and after depositing the heaviest portion in the sedimentation tanks, finally in a greater or lesser percentage amount rests upon the filter bed which is interposed between the treated water and the outlet. This coagulum, with its entangled suspended matter resting upon the filter bed, offers to the flowing treated water a closer and more compact surface than would be offered by the sand grains of which the filter bed is composed.

One of the most important differences existing between the mechanical or American filter and its rival or forerunner, the "slow sand" or European filter, consists in the fact that the latter depends upon a natural formation of coagulum by the bacteria themselves; this is called by the Germans "Schmutzdecke." Mechanical filtration provides for the manufacture of its own coagulum through mechanical and chemical processes. Coagulation in this country gradually resolved itself into the employment of the double salt of alumina and potash, commonly called alum, and latterly for commercial reasons has been succeeded by the simple sulphate of alumina. A very common example of the work accomplished by a coagulum is that furnished by the practice of clarifying coffee by means of the white of egg.

*The following equations explain the chemical reactions technically:

(1) Where alum is used:
$K_2Al_2(SO_4)_4+3CaCO_3+3H_2O=3CaSO_4+K_2SO_4+3Co_2+Al_2(OH)_6$

(2) Where sulphate of alumina is used:
$Al_2(SO_4)_3+3CaCo_3+3H_2O=3CaSO_4+3CO_2+Al_2(OH)_6$

The sedimentation tanks are often concreted at the bottom, and the concrete slopes from a foot at the periphery of the tank to practically nothing at the sewer outlet in the center. This is done to facilitate the discharge of the accumulated, coagulated refuse to the sewer during washing. The necessity of washing the settling tank and filters varies as to the water applied.

A complete gravity plant of the mechanical type is arranged as follows: The raw, unfiltered water is lifted by means of low-service pumps to settling tanks constructed of wood, steel or masonry. The supply from the pumps, entering at about eighteen inches from the bottom of the settling tanks, has injected into it a measured quantity of solution of sulphate of alumina or sulphate of iron. This coagulant, because of the presence in the water of the carbonates of lime, etc., or, failing that, because of a measured quantity of clear lime-water added thereto, decomposes into the insoluble coagulum, in one case hydrate of alumina being formed, in the other case hydrate of iron. The coagulated water, after entering the settling tanks, gradually rises to the level of the overflow dams, which are placed near the top of the subsiding tanks. The coagulated water in rising to that height gradually leaves behind it in the settling tank the coagulated, suspended impurities to a greater or lesser degree, and these impurities accumulate upon the bottom of the settling tank, while the water, divested to a greater or lesser degree of these impurities, spills or overflows to and upon the filter beds, which are situated exterior to and lower than the settling tanks. The filter tanks consist of certain units constructed of wood, steel, concrete or masonry, very often circular in form, in some cases rectangular. Within these filter tanks, superimposed upon a manifold system of piping connected to a screen system, are the sand beds. The sand employed is sharp river sand, running between twenty and forty mesh, and the average depth in use is about four feet. These filters must be elevated to a height to allow for sufficient head above the clear well, that a requisite amount of water may pass through them, the rate of flow as best practiced being two gallons per minute per square foot of area. On the other hand, the filters must not be elevated beyond a point below the overflow dam of the subsidence basin or settling tank in order to give the necessary head required to carry the subsided water upon the filter bed. The filters are directly connected to the overflow dam of the settling tank.

The Air Wash in Mechanical Filtration

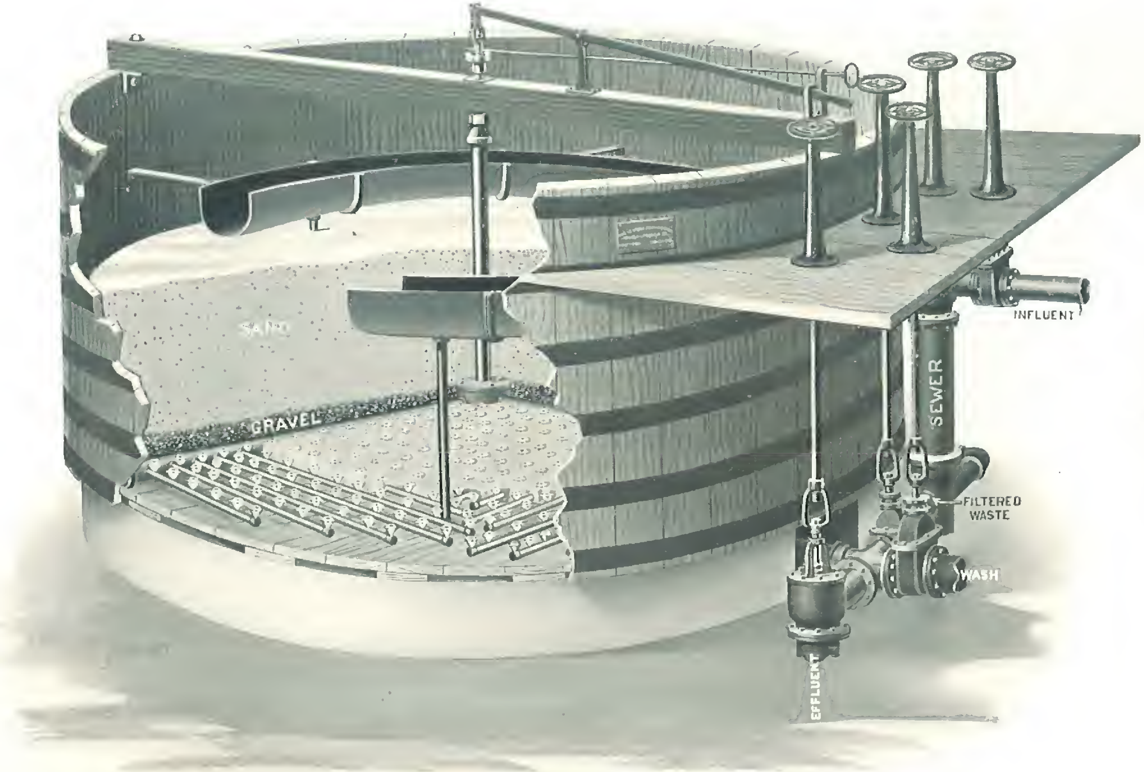
During the process of washing a filter a reverse stream of water is forced, under pressure, upward through the filtering material to flush off the impurities collected during the time the filter is in operation. In accordance with the Law of Areas this reverse stream of wash water is restricted within a limited space, outside of which the congested filter bed tends to "break" or "channel." It is necessary, therefore, in order to properly wash filter beds beyond a certain area, to assist this reverse current with mechanical force; it is also economical to do so. The mechanical agitator or rake is designed for that purpose, and within the limit of circular construction answers the purpose perfectly. The "Sectional Wash" strainer system also has its place. The "Air Wash," however, has the advantage of being applicable to any form of construction, and experiment and use demonstrate that it is equally efficient. The Continental "Trapped Screen" Single Air Wash system, as employed at Little Falls, N.J.; Middletown and Ithaca, N.Y.; Moline, Danville, Cairo, Ill.; Vincennes, Ind.; Bristol-Warren, R.I.; Scranton, Pa.; Newport, R.I., etc., is the highest development and best mechanical method of washing a filter bed with air. At the Little Falls plant a duration of only nine minutes is necessary to completely wash a million-gallon filter unit.

The trapped air under pressure perforates the packed filtering material equidistantly and under equal pressure and permits the incoming reverse stream of wash water to reach all portions of the filter bed evenly and remove by flushing to the sewer opening, the impurities collected during filtration, leaving the filter bed clean and again ready for its purpose of purifying water.

Prior to the invention of the Williamson Trapped Air Wash it was the practice to provide separate air pipes paralleling the water distribution system. This is still resorted to by engineers and manufacturers anxious to avoid patented features necessarily covering the more improved trapped system. We claim for the Williamson Air Trapped system greater economy in cost and distribution.

Improved "New York" Sectional Wash Gravity Filter

Constructed of Steel or Wood and delivered "knocked down"

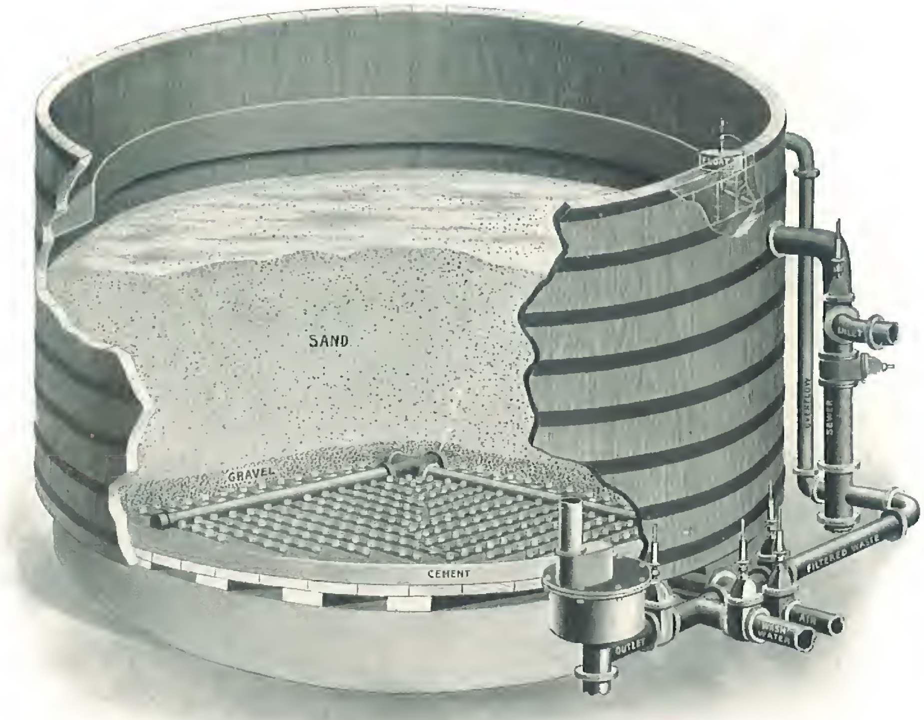


For schedule of sizes, weights and capacities see page 15

Embodying the "Sectional Wash" feature as described on page 4

"Continental" Air Wash Gravity Filter

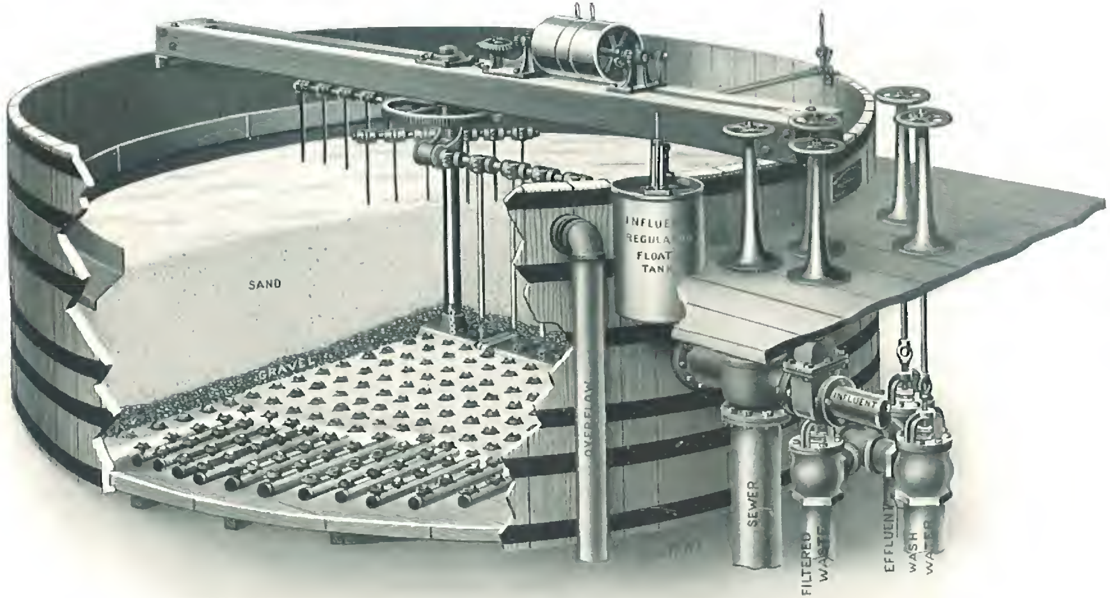
Constructed of
Steel or Wood,
and delivered
"knocked down"



For schedule
of sizes, weights
and capacities,
see page 15

For description of the "Air Wash" see pages 4 and 8

"Modified Jewell" Gravity Filter



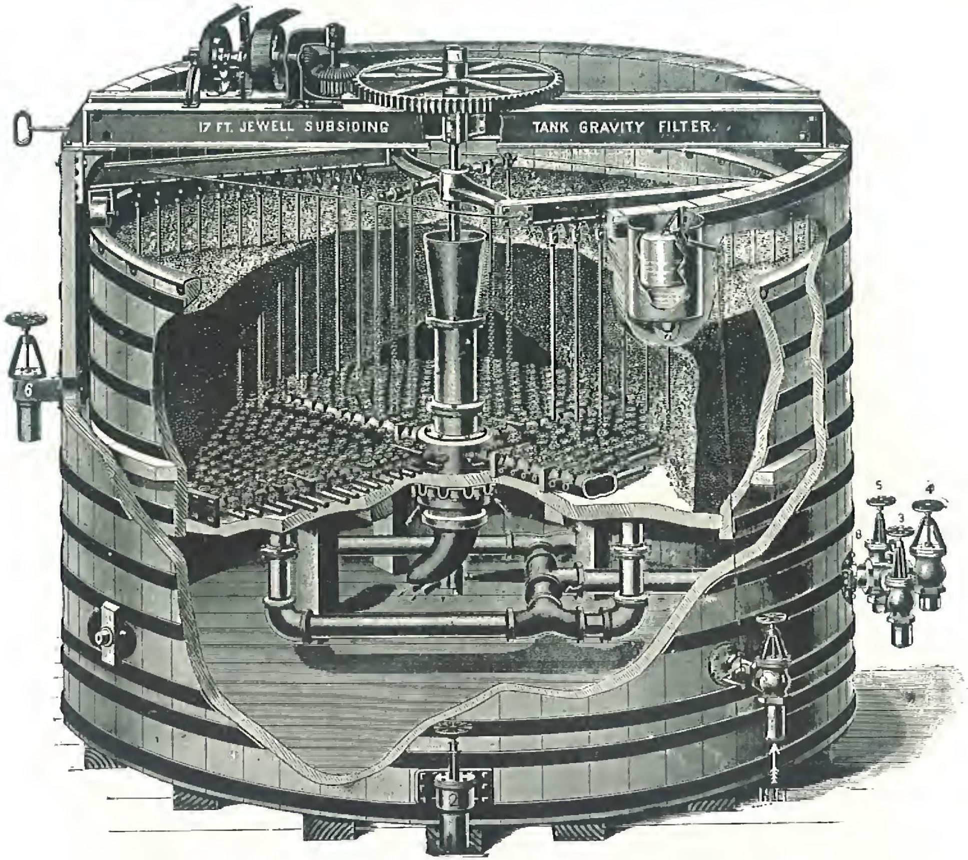
Constructed of Steel or Wood and delivered "knocked down"

For schedule of sizes, weights and capacities see page 15

See description on page 4

"Jewell" High Type Gravity Filter

Constructed of Steel or Wood and delivered "knocked down"

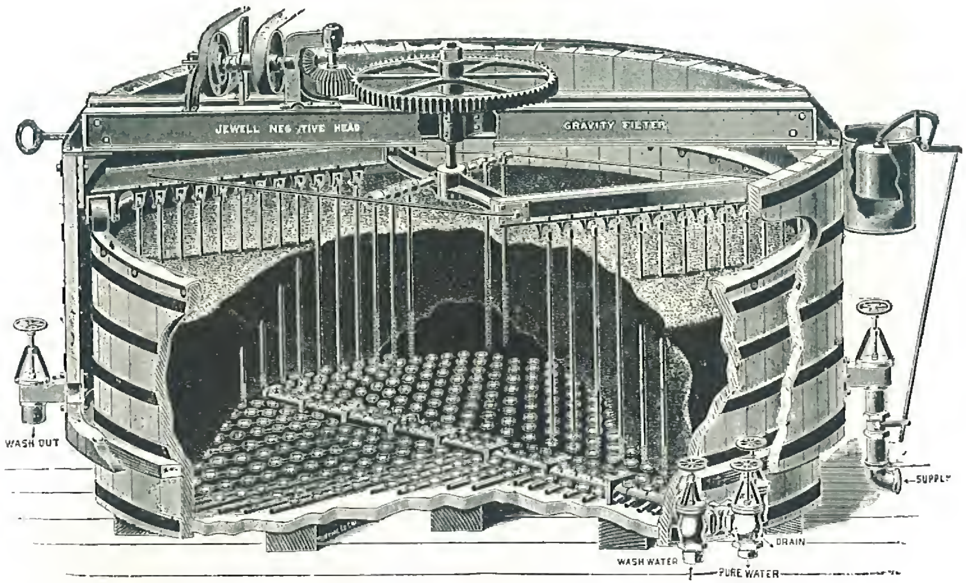


For schedule of sizes, weights and capacities see page 15

See description on page 5

"Jewell" Low Type Gravity Filter

Constructed of Steel or Wood, and delivered "knocked down"

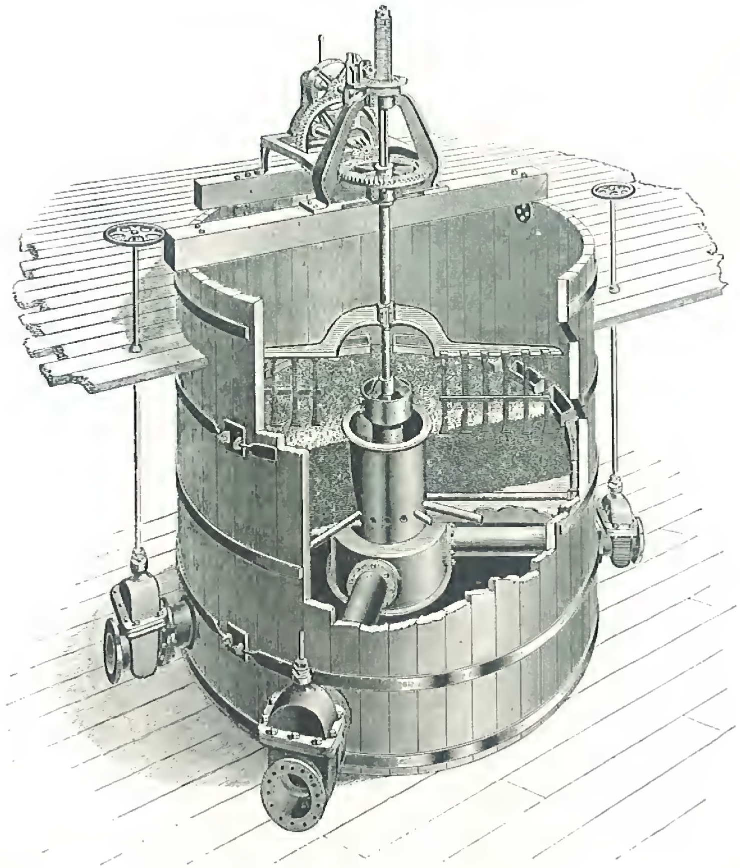


For schedule of sizes, weights and capacities, see page 15

See description on page 5

"Warren" Gravity Filter

Constructed of
Steel or Wood,
and delivered
"knocked down"



For schedule
of sizes, weights
and capacities,
see page 15

For description see page 5

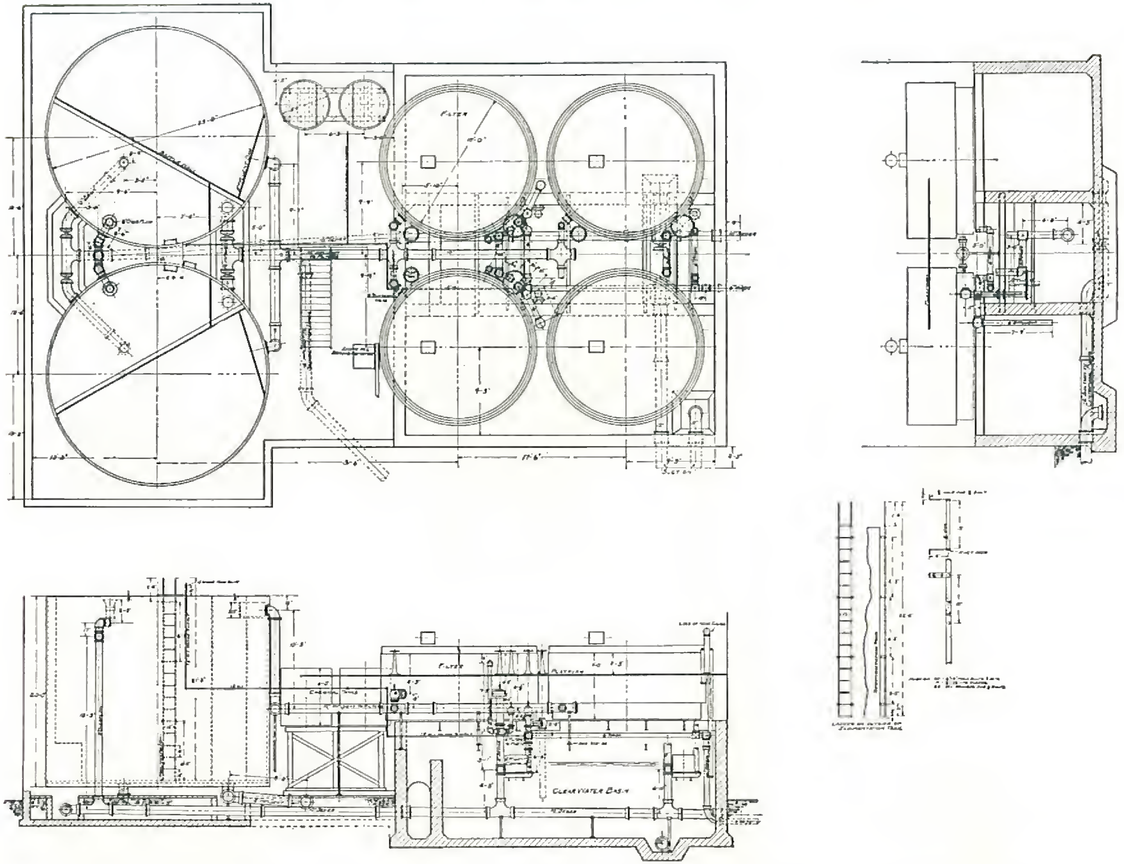
Schedule of Sizes, Capacities, and Weights — Gravity Filters

Capacities shown are the minimum rate for muddy and contaminated waters

Type	Diameter	Height of Filter Tank	Inlet and Outlet Pipes	Waste Pipes	Capacity in U. S. Gallons			Approximate Shipping Weights—Lbs.		
					Minute	Hour	24 Hours	Tank	Parts	Filter Beds
New York	8′	7′	4″	5″	100	6,000	144,000	2,800	3,300	19,000
	10′	7′	5″	6″	157	9,420	226,080	3,700	4,400	29,500
	13′	7′	6″	8″	265	15,900	381,600	5,200	6,050	50,000
	15′	7′	6″	8″	353	21,180	508,320	6,200	7,050	66,800
	17′	7′	8″	10″	454	27,240	653,760	7,000	10,050	86,000
Continental	8′	7′	4″	5″	100	6,000	144,000	2,800	3,300	19,000
	10′	7′	5″	6″	157	9,420	226,080	3,700	4,400	29,500
	13′	7′	6″	8″	265	15,900	381,600	5,200	6,050	50,000
	15′	7′	6″	8″	353	21,180	508,320	6,200	7,050	66,800
	17′	7′	8″	10″	454	27,240	653,760	7,000	10,050	86,000
Jewell High Type	6′	16′	3″	6″	57	3,420	82,080	8,300	2,000	12,000
	8′	16′	4″	6″	100	6,000	144,000	11,700	3,000	20,000
	10′	16′	4″	8″	157	9,420	226,080	14,700	4,000	32,000
	12′	16′	6″	8″	226	13,560	325,440	18,500	7,000	46,000
	14′	16′	6″	8″	308	18,480	443,520	22,600	8,000	62,000
	15′	16′	6″	8″	353	21,180	508,320	25,500	10,000	71,000
	17′	16′	8″	8″	454	27,240	653,760	29,700	17,000	91,000
	24′	16′	10″	10″	905	54,300	1,303,200	32,000	18,000	160,000
Jewell Low Type and Modified Jewell	6′	7′	3″	6″	57	3,420	82,080	5,000	1,500	12,000
	8′	7′	4″	6″	100	6,000	144,000	5,800	2,500	20,000
	10′	7′	4″	8″	157	9,420	226,080	7,000	3,500	32,000
	12′	7′	6″	8″	226	13,560	325,440	9,000	6,000	46,000
	14′	7′	6″	8″	308	18,480	443,520	11,000	7,000	62,000
	15′	7′	6″	8″	353	21,180	508,320	12,000	9,000	71,000
	17′	7′	8″	10″	454	27,240	653,760	15,000	15,000	91,000
	24′	7′	10″	10″	905	54,300	1,303,200	20,000	16,500	160,000
Warren	8′ 8″	8′ 5″	8″	6″	118	7,080	169,920	3,600	8,430	12,500
	10′ 6″	8′ 5″	8″	6″	173	10,380	249,120	4,400	9,040	18,000
	12′ 6″	9′ 11″	8″	6″	245	14,700	352,800	5,500	10,210	26,000
	13′	9′ 11″	8″	6″	265	15,900	381,600	6,400	10,250	28,000

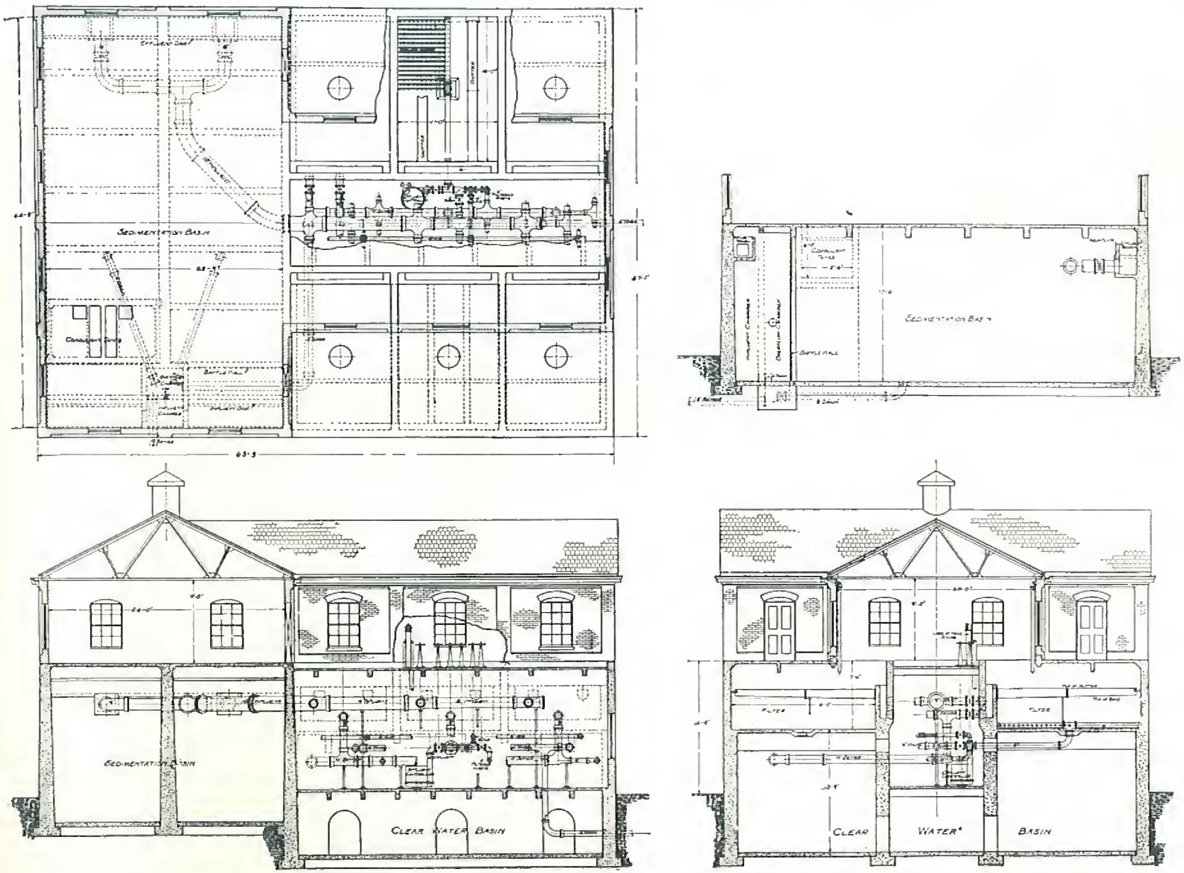
CAPACITIES given are based upon a rate of 2 gallons per square foot of filtering area per minute, at which rate they will deliver a bacterially pure as well as a perfectly clear water. It is advisable to refer the question of capacity to us, as a much greater capacity than shown is ofttimes obtainable.

Typical Wooden Construction Gravity Plant



General Plan and Section of a 2,000,000-Gallon Gravity Filter Plant. Wood Tank Construction

Typical Concrete Construction Gravity Plant



General Plan and Section of a 3,000,000-Gallon Gravity Filter Plant. Concrete Construction

Chemical and Bacteriological Results

East Jersey Water Co., Little Falls, N. J.

Averages — (For Fiscal Years Beginning September 1st)

YEAR AND MONTH	Average Period of Service	Filtered Water Million Gals. a Day		Per Cent. of Wash Water	Sulphate of Alumina		Parts per Million						Bacteria per Cubic Centimetre	
		Total	Net		Pounds per Day	Grains per Gallon	Alkalinity		Turb.		Color			
							River	Fil.	River	Fil.	River	Fil.	River	Fil.
1902-1903	9.55	12.8	12.4	3.5	2,330	1.28	28	19	11	1	35	6	3,500	70
1903-1904	10.55	17.2	16.7	2.8	3,060	1.26	29	21	18	0	34	6	2,600	55
1904-1905	10.89	23.0	22.4	2.6	4,150	1.28	33	24	12	0	29	5	1,500	50
1905-1906	10.52	22.1	21.4	3.2	4,720	1.49	27	16	8	0	32	4	2,500	110
1906-1907	9.29	24.5	23.6	3.8	4,340	1.24	30	22	9	0	25	3	2,000	65
1907-1908	10.23	24.7	23.8	3.6	4,940	1.41	24	14	9	0	31	3	1,300	35
1908-1909	10.38	24.2	23.4	3.5	4,930	1.44	32	22	9	0	28	3	2,900	48
1909-1910	10.41	26.8	26.0	3.7	7,740	2.05	32	21	10	0	40	5	5,300	100
1910-1911	11.36	28.4	27.3	3.9	4,530	1.12	31	24	11	0	45	8	4,500	16
1911-1912	12.73	30.8	29.9	2.8	5,450	1.25	26	18	11	0	48	8	3,100	3
September, 1912	10.80	30.8	29.9	3.1	6,450	1.47	41	30	7	0	41	8	750	2
October	10.63	30.7	29.8	3.1	8,790	1.93	35	23	10	0	56	7	1,100	4
November	11.00	29.4	28.5	3.0	13,320	3.16	22	7	10	0	61	14	2,000	4
December	15.14	30.3	29.6	2.3	7,790	1.86	23	12	8	0	40	11	1,800	3
January, 1913	15.29	28.9	28.3	2.2	4,370	1.06	14	7	8	0	39	7	1,300	2
February	17.72	31.8	31.2	1.9	6,120	1.36	23	14	8	0	31	9	1,000	1
March	13.45	29.1	28.4	2.5	3,470	.84	15	10	12	0	43	8	1,500	2
April	13.19	28.1	27.4	2.5	4,410	1.10	18	11	7	0	40	8	800	1
May	11.15	28.7	27.8	3.0	6,070	1.48	27	16	8	0	44	7	1,200	0
June	10.67	30.7	29.8	3.1	7,060	1.61	36	24	8	0	49	10	600	1
Average	11.90	26.7	25.9	3.0	6,702	1.48	27	18	10	0	40	7	2,063	29

FRANK W. GREEN, Superintendent Filtration Works

Little Falls, N. J.

Operated by the East Jersey Water Co. Planned and equipped by The New York Continental Jewell Filtration Co.

The Original Reinforced Concrete Filter Plant. A departure from previous type.

View of one of the Filter Galleries. The openings into the filters are shown on both sides of the floor. The iron plates between the operating tables are covers for the openings into the pipe gallery below

Installed in 1902. Daily capacity 32,000,000 gallons; filtering Passaic River water

General View of Filter Gallery

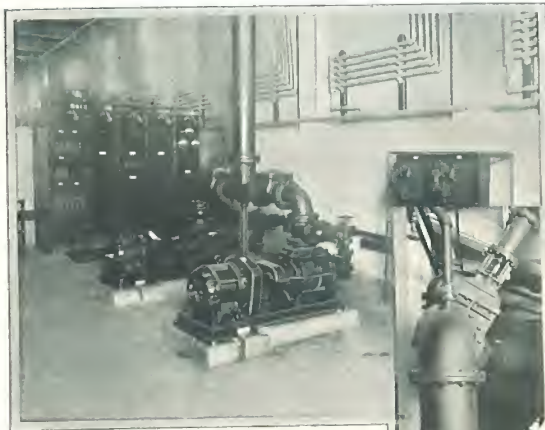
Installed in 1912. Daily capacity 30,000,000 gallons; filtering Ottawa and St. Lawrence Rivers water

Filter Gallery

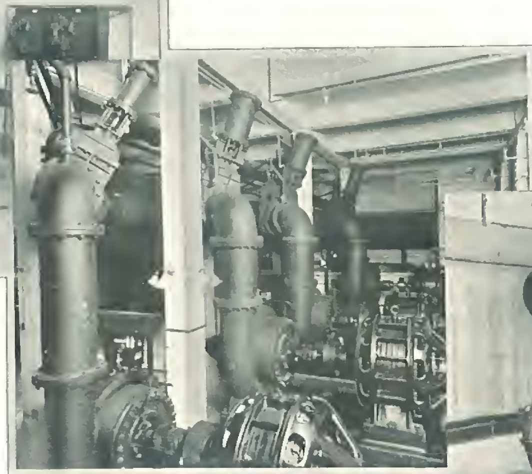
Office

Operating Table

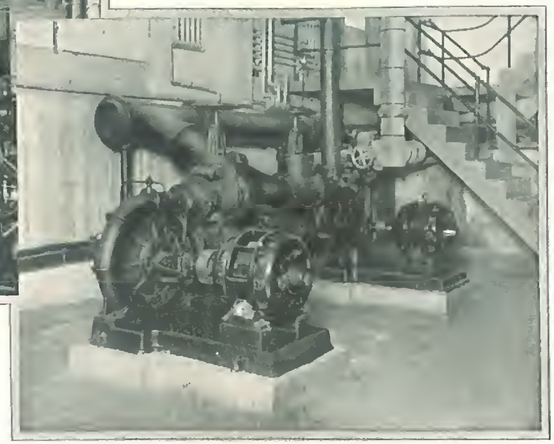
Montreal, Canada



Blowers



Raw Water Pumps

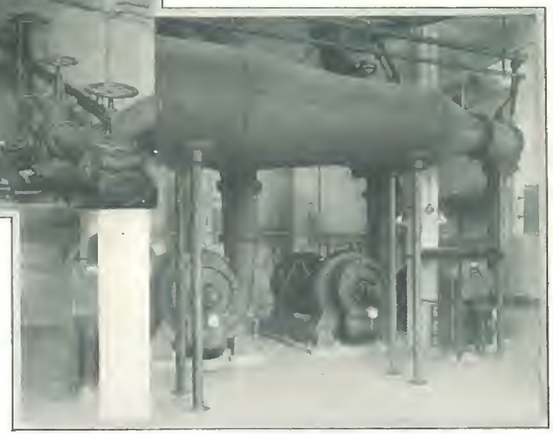


Wash Pumps

Montreal, Canada

Overlooking Motor Room

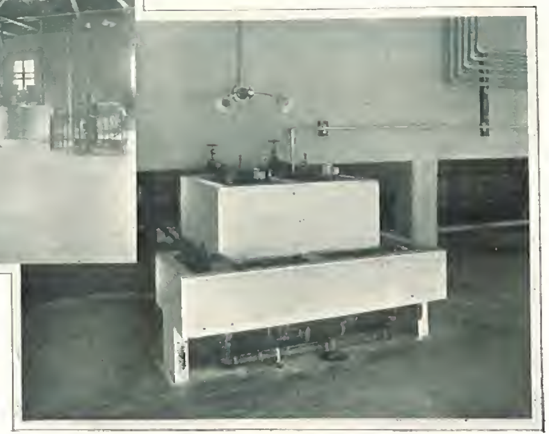
Motor Room



Raw Water Pumps and Flume

Hypo Orifice Tanks

Chemical Mixing Room



Sulphate of Alumina Orifice Tanks

Installed in 1909. Daily capacity 6,000,000 gallons; filtering an impounded water

Installed in 1908. Daily capacity 3,000,000 gallons; filtering Kickemuit River water

Bangor, Maine, Filtration Plant

Daily Report of Operation — General Average 1911-1912

DATE	Coagulant: Alumina	Coagulant: Lime	Bacteria per C. C.		Efficiency	B. Coli		City Tap			Turbidity				Color		
	Grains per Gal.	Grains per Gal.	Raw	Filtered	Total	Raw	Filtered	Bacteria per C. C.	B. Coli.	Turbidity	Color	Raw	Filtered	Per Cent Removed	Raw	Filtered	Per Cent Removed
1911																	
March.......	2.12	0.49	3,906	194	95.04	76–93	3–93	205	2–93	0	11.5	1.20	.4	......	47.6	10.5	77.85
April.........	2.00	0.19	7,231	117	98.39	63–87	2–87	53	0–87	0	6.1	3.80	0	......	49.0	5.7	88.37
May.........	2.00	0.27	2,607	54	97.93	74–90	1–90	37	0–90	0	8.1	.80	0	......	59.0	8.0	86.45
June.........	2.06	0.24	2,606	61	97.66	78–81	2–84	53	0–81	0	7.5	.30	0	......	64.3	7.8	87.87
July.........	2.00	0.15	2,201	43	98.05	76–78	0–78	39	0–78	0	4.0	.00	0	......	51.0	4.0	92.16
August.......	2.00	0.10	2,133	40	98.13	87–91	1–91	42	0–91	0	4.6	.00	0	......	51.8	5.2	89.97
September....	2.00	0.11	3,210	46	98.57	78–90	1–90	41	0–90	0	6.5	.16	0	......	54.4	6.5	88.06
October......	2.11	0.15	2,490	34	98.63	85–93	3–93	27	0–93	0	7.8	.00	0	......	58.4	7.5	87.16
November....	2.04	0.11	3,023	48	98.42	86–90	2–90	36	2–90	0	9.0	1.00	0	......	61.0	8.0	86.89
December....	2.06	0.10	4,084	72	98.24	63–72	3–75	55	1–75	0	13.0	.90	0	......	69.0	10.0	85.50
1912																	
January......	2.00	0.11	3,358	45	98.66	84–93	2–93	34	0–93	0	9.5	.00	0	......	56.5	8.0	85.84
February.....	2.00	0.10	2,578	44	98.30	71–87	2–87	31	0–87	0	7.3	.00	0	......	50.3	6.3	87.48
Total........						921-1045 88.13%	22-1051 2.09%		5-1048 .47%								
Average......	2.03	0.17	3,286	67	97.97			54		0	7.9	.68	.03	95.59	56.0	7.3	86.97

JAMES M. CAIRD, Chemist and Bacteriologist, Troy, N. Y.

Installed in 1911. Daily capacity 8,000,000 gallons; filtering Penobscot River water

Clarksburg, W. Va., Filtration Plant

Annual Laboratory Report of the Chemist-in-Charge

1912-1913

MONTH	TURBIDITY			ALKALINITY			BACTERIA Per C.C.			B. COLI Per cent of times present in these quantities of water				
										RAW			FILTERED	
	Raw	Coag'd	Filtered	Raw	Lime Treated	Filtered	Raw	Coag'd	Filtered	0.1 C.C.	1.0 C.C.	10 C.C.	1.0 C.C.	10 C.C.
January	67	11	0	14	24	12	950	110	7	45	65	90	0	0
February	110	21	0	13	27	12	800	190	11	24	45	86	0	0
March	189	26	0	10	30	13	1,350		11	64	81	100	0	0
April	143	20	0	15	23	14	1,450		8	20	57	97	0	0
May	50	13	0	24		19	2,000		14	61	84	97	0	0
June	84	15	0	29		23	1,100		11	67	98	100	0	0
July	208	16	0	29		19	2,900		6	35	71	100	0	0
August	44	15	0	35		29	1,000		2	7	60	100	0	0
September	104	19	0	30		19	1,900		3	17	63	97	0	0
October	30	10	0	27		23	400		1	3	42	100	0	0
November	42	15	0	30		21	850		1	0	27	83	0	0
December	78	18	0	28		19	1,200		2	19	55	90	0	0
January	145	40	0	10	29	29	400		1	55	84	90	0	0
Averages for 13 months	99	19	0	23		19	1,300		6					

Averages for bacteria are recorded to the nearest two significant figures as adopted by the "Standard Methods."

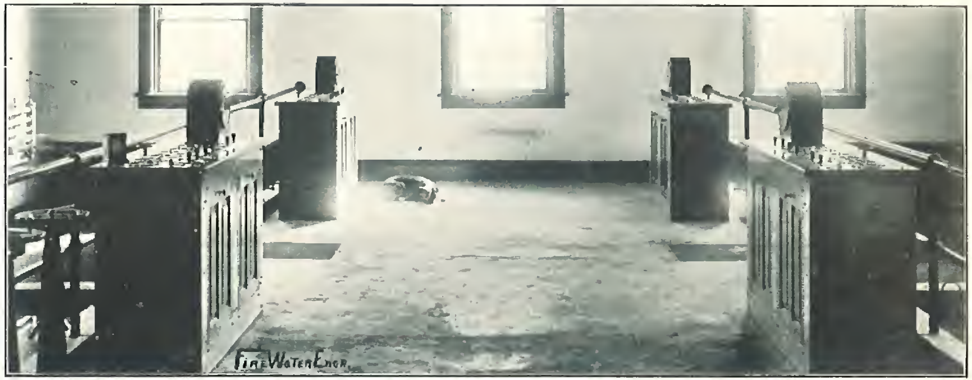
The highest number of bacteria in the river water was 15,000. The highest number of bacteria in the treated water was 50. The counts for bacteria were made on nutrient agar at 40 deg. C. The tests for Bacillus Coli were made in Neutral Red at 40 deg. C. Average bacterial removal for the year, 99.9 per cent.

Respectfully submitted,

PERKINS BOYNTON, Chemist-in-Charge

Clarksburg, W. Va.

Filter Building



Operating Floor

Installed in 1911. Daily capacity 3,000,000 gallons; filtering Monongahela River water

Springfield, Mo.

Filter Building

Operating Floor

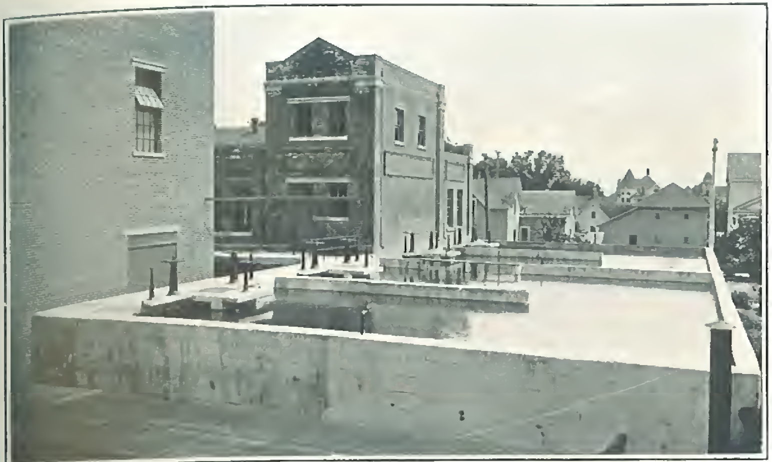
Installed in 1910. Daily capacity 6,000,000 gallons; filtering water from Fullbright Spring

Cohoes, N. Y.

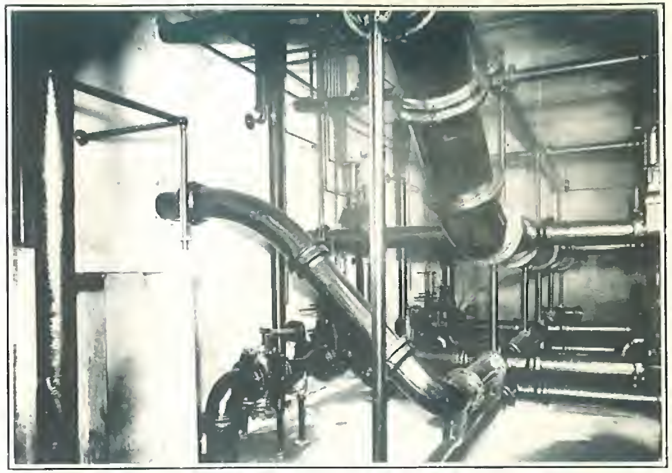
Installed in 1911. Daily capacity 8,000,000 gallons; filtering Mohawk River water

Installed in 1909. Daily capacity 6,000,000 gallons; filtering an impounded supply

Albany, Oregon



View Showing Sedimentation Basin



Pipe Gallery

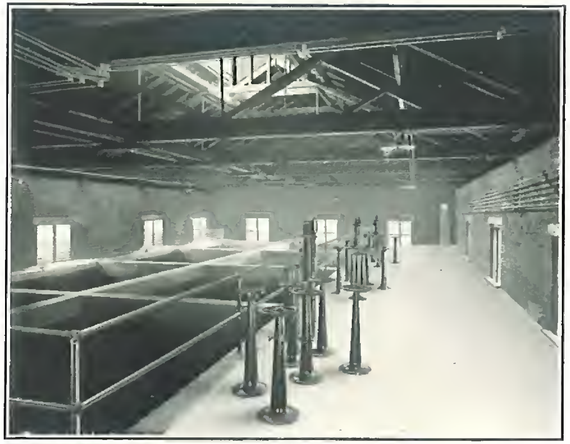
Operating Floor

Clear Water Basin

Installed in 1911. Daily capacity 2,000,000 gallons

Ottumwa, Iowa

Filter Building



Operating Floor

Installed in 1911. Daily capacity 4,000,000 gallons; filtering Des Moines River water

Cherryvale, Kansas

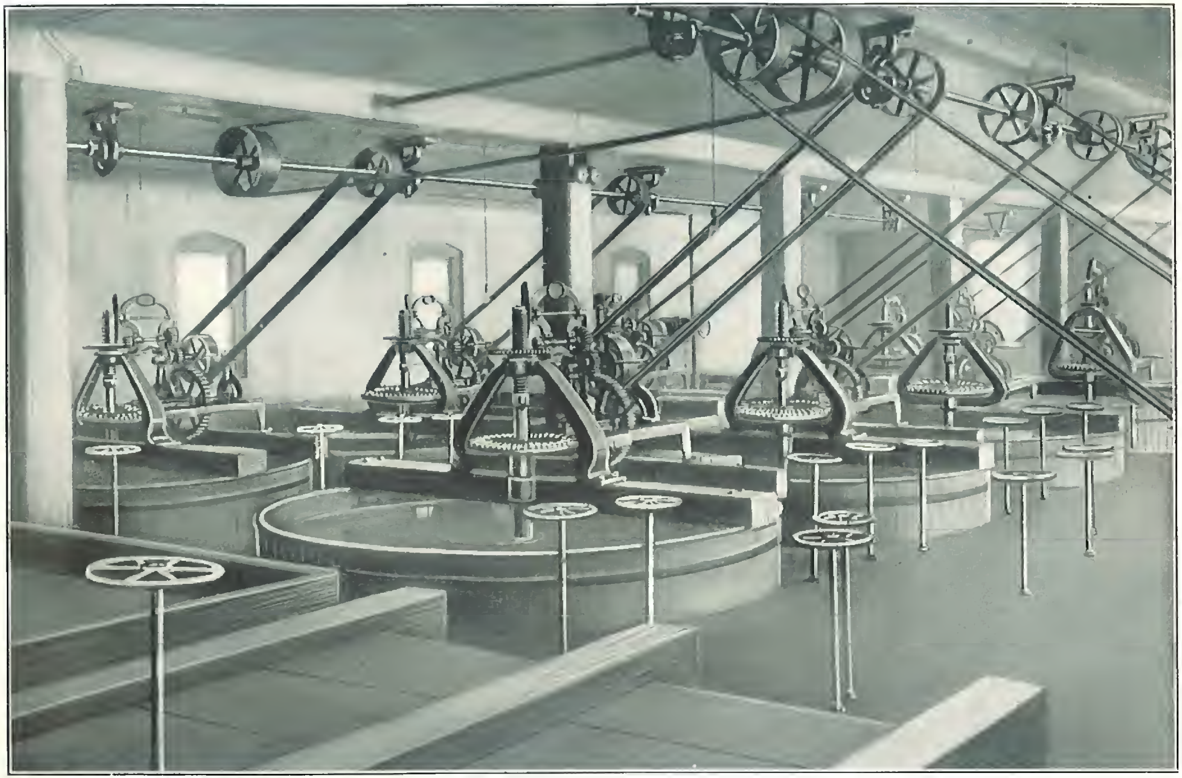
Filter Building

Operating Floor

Installed in 1911. Daily capacity 1,400,000 gallons; filtering Verdegris River water

Longue Pointe, Canada

Installed in 1912. Daily capacity 750,000 gallons; filtering St. Lawrence River water



Installed in 1896. Daily capacity 5,500,000 gallons; filtering Saco River water

Test of Elmira Water, Light and Railroad Co.'s Plant

DATE	Bacteria			Turbidity			Color			Alkalinity			Alumina	Lime	B. Coli Comm.		Per Cent. of Wash Water
	Raw Water	Filtered Water	Per Cent. Removed	Raw Water	Filtered Water	Per Cent. Removed	Raw Water	Filtered Water	Per Cent. Removed	Raw Water	Filtered Water	Parts Used	Grains per Gallon	Grains per Gallon	Raw	Filtered	
1898 Average	2,280	76	96.67	....	....	.....	....	....	.....	.....	....	....	.50	....	....	....	....
1899 "	6,019	121	97.99	....	....	.....	....	....	.....	.....	....	....	1.28	.50	....	....	....
1900 "	547	17	96.90	....	....	.....	....	....	.....	94.4	83.8	10.6	1.03	....	....	....	2.6
1901 "	1,394	17	98.71	60.0	0.0	100.00	28.1	0.0	100.00	101.1	83.5	17.6	1.36	....	....	....	2.0
1902 "	10,905	402	96.32	67.0	0.0	100.00	30.9	1.2	96.12	53.4	36.2	17.2	2.18	.25	....	....	1.6
1903 "	7,646	230	97.00	56.0	3.0	94.65	23.0	.6	97.40	60.2	45.7	14.5	1.89	.10	5–5	1–5	2.4
1904 "	1,761	50	97.17	62.0	0.0	100.00	24.6	1.0	95.94	42.5	31.5	11.0	1.68	.059	14–15	2–15	2.1
1905 "	8,137	831	98.98	30.0	0.0	100.00	18.8	0.0	100.00	65.4	33.0	12.4	1.57	.33	83–193	4–193	2.2
1906 "	7,433	429	99.43	72.2	0.0	100.00	23.8	0.0	100.00	55.1	43.4	11.7	1.57	.49	433–535	103–535	2.3
1907, January	27,747	51	99.82	73.0	0.0	100.00	26.0	0.0	100.00	23.2	11.6	11.6	1.66	....	14–24	0–24	2.5
February	10,489	208	98.02	14.5	0.0	100.00	6.6	0.0	100.00	70.4	56.7	13.7	1.54	....	34–39	11–39	1.9
March	38,400	147	99.62	61.5	0.0	100.00	24.0	0.0	100.00	45.3	33.0	12.3	1.71	....	20–36	2–36	2.6
April	7,716	40	99.48	92.1	0.0	100.00	26.4	0.0	100.00	30.1	18.6	11.5	1.61	....	19–30	2–30	2.5
May	3,150	19	99.40	22.2	0.0	100.00	23.5	0.0	100.00	39.6	28.1	11.5	1.52	....	18–24	2–24	2.2
June	3,146	21	99.34	31.8	0.0	100.00	21.1	0.0	100.00	54.1	43.2	10.9	1.45	....	14–24	0–24	2.5
July	4,155	16	99.62	45.0	0.0	100.00	23.7	0.0	100.00	62.0	50.0	12.0	1.55	....	23–33	0–33	2.6
August	609	10	98.36	12.1	0.0	100.00	10.8	0.0	100.00	82.7	71.5	11.2	1.52	....	17–33	0–33	2.8
September	726	7	99.04	12.0	0.0	100.00	12.0	0.0	100.00	72.0	61.0	11.0	1.52	....	12–36	0–36	2.9
October	3,166	36	98.87	12.0	0.0	100.00	17.8	0.0	100.00	60.5	49.3	11.2	1.51	....	23–38	0–38	2.3
November	7,112	40	99.44	21.9	0.0	100.00	21.3	0.0	100.00	43.0	32.0	11.0	1.52	....	21–42	0–42	2.4
December	4,919	23	99.54	20.8	0.0	100.00	21.1	0.0	100.00	35.9	25.1	10.8	1.52	....	15–48	0–48	2.5
Average	9,278	515	99.46	34.9	0.0	100.00	19.5	0.0	100.00	51.5	40.0	11.5	1.55	....	230–407	7–407	2.4
1908, January	19,224	116	99.40	13.0	0.0	100.00	14.4	0.0	100.00	40.0	28.0	12.0	1.60	....	40–50	5–50	2.3
February	24,275	110	99.55	16.8	0.0	100.00	12.2	0.0	100.00	47.8	37.3	10.5	1.62	....	47–79	11–79	2.9
March	26,268	120	99.55	97.5	0.0	100.00	24.3	0.0	100.00	24.8	15.9	8.9	1.60	....	18–78	1–78	3.3

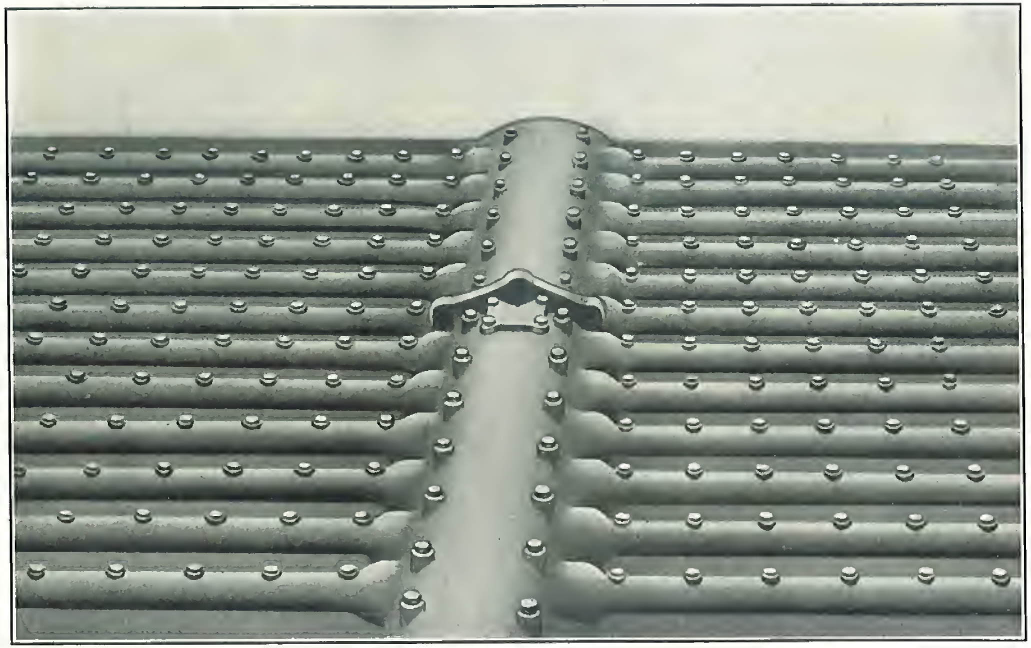
JAMES M. CAIRD, Chemist and Bacteriologist, Troy, N. Y.

"Jewell" Gravity Filter Plant as Installed at Elmira, N. Y., and Elsewhere

Wooden Construction

The plant at Elmira has been in successful operation since 1897; daily capacity 7,000,000 gallons; filtering Chemung River water

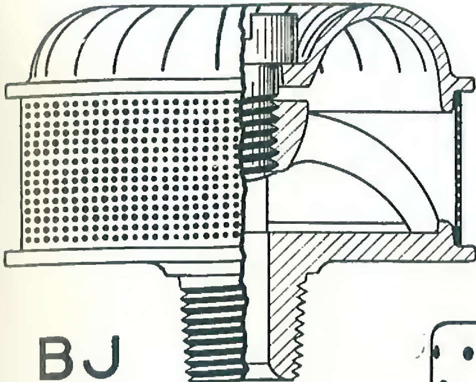
Constructed
with or
without
air washing
arrangement



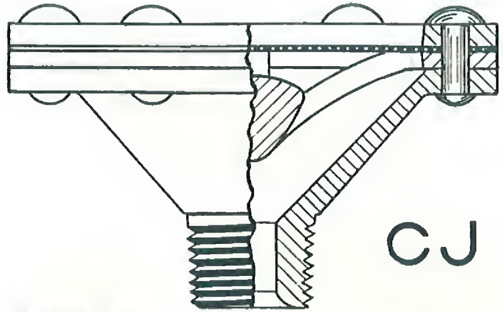
Concreted
in place,
affords
perfect
distribution

Strainer system with header and manifolds; arranged for air wash

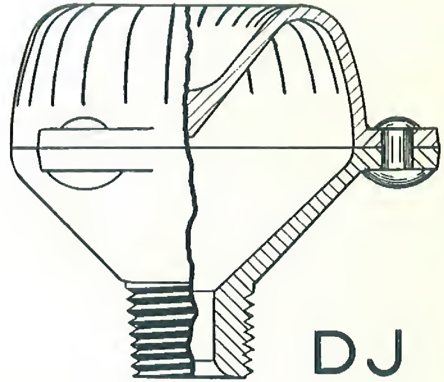
Patented Strainers



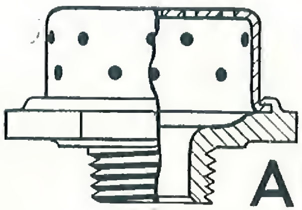
BJ



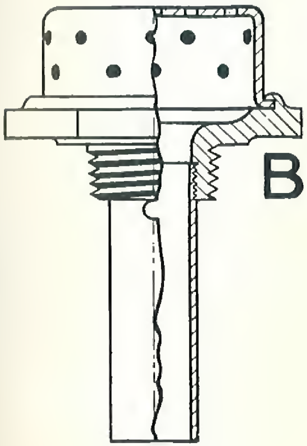
CJ



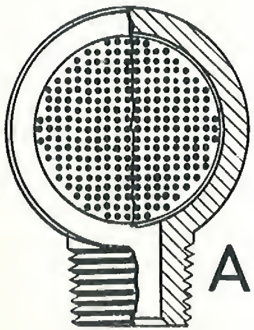
DJ



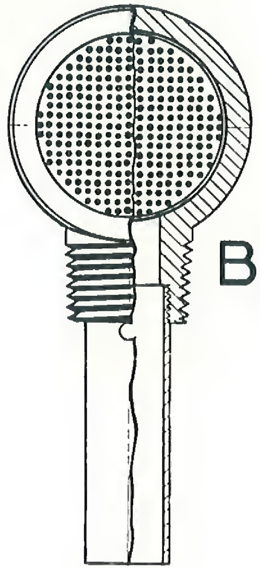
AC



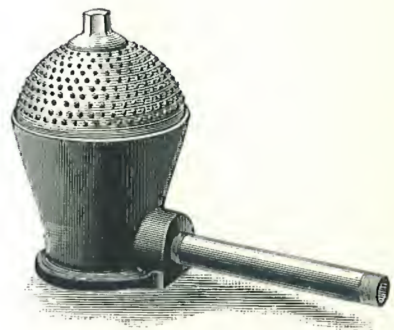
BC



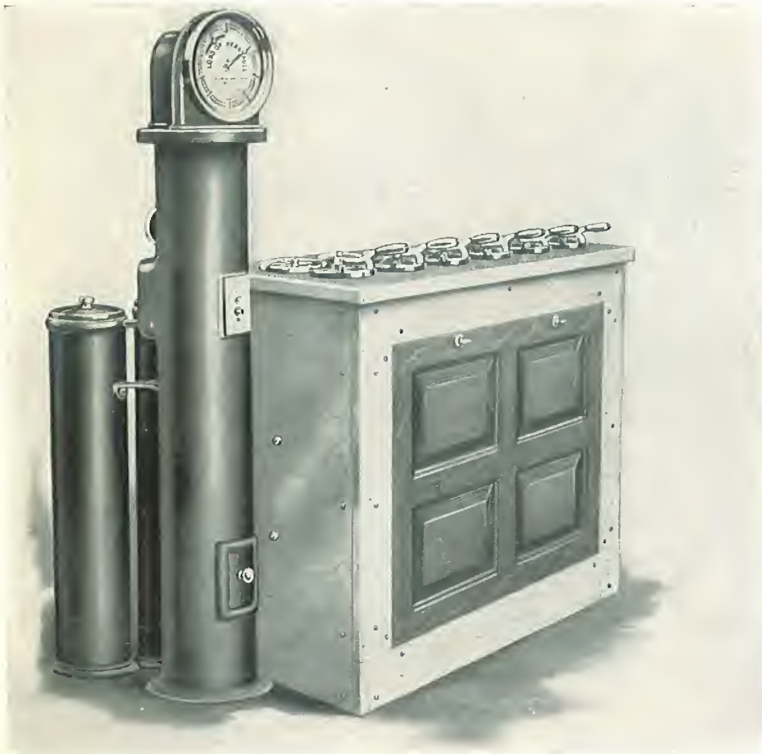
AE



BE



Cone Valve



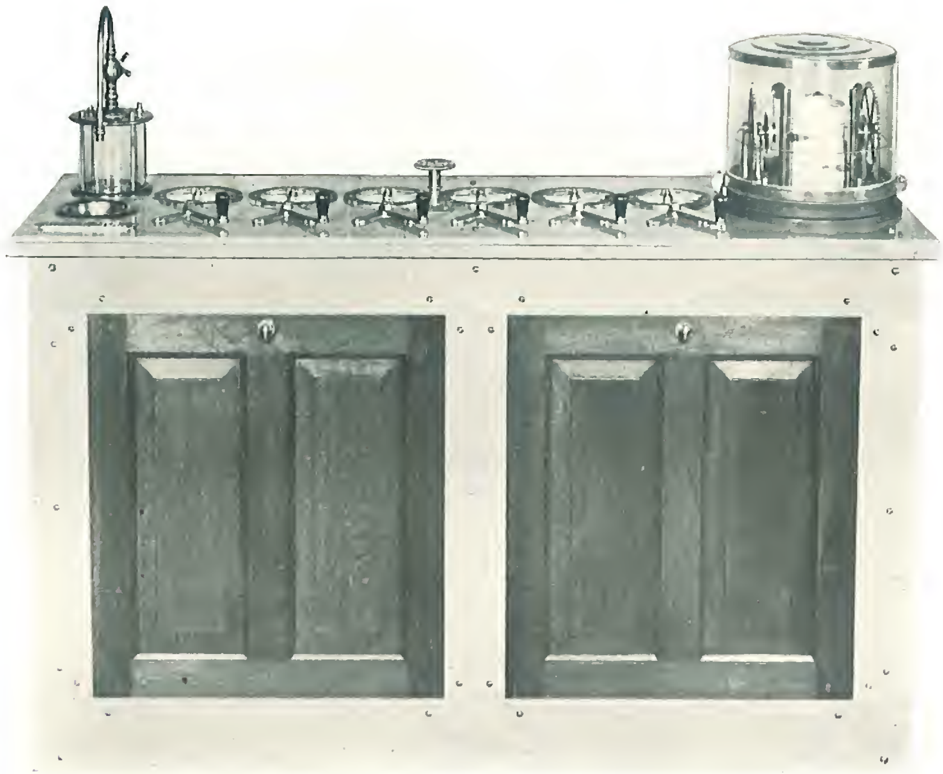
Operating Table

Dial of Loss of Head Gauge shown at left of operating table

For recording "loss of head." When "loss of head" reaches a given number of feet, as indicated, the filter should be washed.

Operating Table

Constructed
of Marble
or Slate,
with Oak Doors



Fittings
Brass or
Nickel Plated

Operating Table with Recording Loss of Head Gauge and Sample Tap

LIST OF MUNICIPAL FILTER PLANTS
OF THE
NEW YORK, CONTINENTAL, JEWELL, HYATT, WARREN, AMERICAN, NATIONAL AND BLESSING TYPES

Adopted by 325 City and Town Water Works. Total Daily Capacity August 1st, 1913, 800,000,000 Gallons.
Seventy-nine of These Cities and Towns Have Increased Their Plants.

*These plants have been increased, the number of stars showing the number of times increased.

Alabama	Daily Capacity, Gallons.
Eufaula	500,000
*Gadsden	1,325,000
Tuscaloosa	500,000
Arkansas	
**Little Rock	5,500,000
California	
Black Diamond	750,000
Ft. Baker	115,000
Hillsboro	175,000
Merced Falls	72,000
*Oakland	7,000,000
Porterville	150,000
Rio Vista	367,000
San Diego	5,000,000
San Francisco (Spring Valley)	2,500,000
Scotia	667,000
*United States Government, Presidio, San Francisco	1,000,000
Watsonville	667,000
Connecticut	
**Greenwich	5,000,000
New Canaan	1,000,000

Georgia	Daily Capacity, Gallons.
***Atlanta	21,000,000
**Athens	3,000,000
*Augusta	8,000,000
Columbus	2,000,000
Eatonton	350,000
Gainesville	1,000,000
***Macon	4,000,000
Milledgeville	500,000
*Rome	2,000,000
West Point	500,000
Illinois	
Alton	3,000,000
*Cairo	3,800,000
Carlinville	100,000
Danville	3,000,000
**Decatur	3,000,000
East St. Louis	10,000,000
**Elgin	3,500,000
*Freeport	2,000,000
*Kenilworth	600,000
Lake Forest	1,000,000
Lawrenceville	325,000
*Moline	5,000,000
Murphysboro	250,000
*Pontiac	1,500,000
**Quincy	4,000,000

	Daily Capacity, Gallons.
*Rogers Park	900,000
Streator	1,500,000
Indiana	
*Anderson	5,000,000
Aurora	1,000,000
Muncie	4,000,000
Seymour	2,000,000
***Terra Haute	9,000,000
Vincennes	2,000,000
Iowa	
Cedar Rapids	2,500,000
Clinton	1,000,000
*Creston	1,000,000
*Davenport	9,000,000
Iowa City	2,000,000
Keokuk	3,500,000
**Oscaloosa	1,250,000
*Ottumwa	4,000,000
***Waterloo	2,500,000
Kansas	
Burlingame	1,000,000
Caldwell	500,000
Cherryvale	1,400,000
Coffeyville	4,000,000

	Daily Capacity, Gallons.
Council Grove	250,000
Kansas City	6,000,000
Oswego	500,000
Paola	250,000
Winfield	1,200,000

Kentucky

**Danville	2,500,000
Hopkinsville	500,000
*Lexington	3,500,000
Paducah	6,000,000
*Winchester	2,250,000

Louisiana

Shreveport	1,000,000

Maine

**Bangor	8,000,000
***Biddeford and Saco	5,500,000
Mechanics Falls	750,000
North Berwick	300,000
Rumford Falls	500,000
Veazie	1,000,000

Maryland

Cantonsville	250,000
Sparrows Point	300,000

Massachusetts

Athol	1,500,000
Reading	1,000,000

Michigan

Adrian	1,750,000

Minnesota

Brainerd	500,000
Breckenridge	1,000,000
*Ely	1,000,000
McKinley	28,000

Mississippi	Daily Capacity, Gallons.
Columbus	500,000
Vicksburg	3,000,000

Missouri

Holden	300,000
**Louisiana	1,800,000
Mexico	800,000
Rich Hill	200,000
*St. Joseph	11,000,000
Trenton	400,000
Washington	200,000
Springfield	6,000,000

Nebraska

Nebraska City	400,000

New Hampshire

*Exeter	114,000
Lebanon	1,000,000

New Jersey

Allentown	144,000
Allenhurst	500,000
Atlantic Highlands	500,000
Asbury Park	2,000,000
Bordentown	500,000
Hightstown	250,000
Keyport	500,000
Lakewood	500,000
Little Falls	32,000,000
*Long Branch	3,000,000
Mt. Holly	1,500,000
**Rahway	4,000,000
Red Bank	12,000,000
***Somerville	3,000,000
South Plainfield	350,000

New York	Daily Capacity, Gallons.
Attica	400,000
*Bainbridge	300,000
Brockport	1,500,000
East Worcester	250,000
*Elmira	7,000,000
Green Island	1,000,000
*Hornell	3,000,000
Ithaca	3,000,000
*Kingston	6,000,000
Cohoes	8,000,000
*Middletown	5,000,000
*Niagara Falls	10,000,000
*Norwich	3,000,000
Oneonta	3,000,000
*Owego	750,000
Pleasantville	144,000
*Rensselaer	4,000,000
Richfield Springs	350,000
Stamford	200,000
Valatie	150,000
*Watervliet Arsenal	420,000

North Carolina

Biltmore	500,000
Charlotte	1,500,000
*Durham	2,000,000
Gastonia	350,000
Goldsboro	500,000
Henderson	350,000
**Raleigh	2,000,000
*Rocky Mount	1,350,000
*Salem	1,200,000
Salisbury	500,000
Shelby	1,000,000
Wilson	1,000,000
**Winston-Salem	2,200,000

Ohio

Bucyrus	500,000
Conneaut	1,000,000
Dennison	2,000,000

	Daily Capacity, Gallons.
Elyria	2,000,000
Geneva	750,000
Newark	2,000,000
Portsmouth	8,000,000
Sandusky	4,000,000
Warren	1,500,000
Oregon	
Arlington	200,000
Albany	2,000,000
Eugene	3,000,000
Hood River	108,000
McMinnville	500,000
**Oregon City	1,500,000
Wauna	60,000
Oklahoma	
Bartlesville	1,000,000
Chickasha	500,000
Shawnee	1,500,000
Pennsylvania	
Arnot	125,000
Berwyn	750,000
**Beaver Falls	3,000,000
Bristol	2,000,000
*Carlisle	1,825,000
Canton	500,000
Clarion	500,000
Connellsville	1,500,000
*Danville	1,000,000
East Greenville	342,000
*Gettysburg	1,000,000
**Holmesburg	2,000,000
New Bethlehem	100,000
New Brighton	500,000
New Castle	4,000,000
*Norristown	4,500,000
Overbrook	250,000
Pickering Creek	750,000
Pottstown	4,000,000
Royersford	700,000
Scranton	6,000,000
*Sharon	2,000,000

	Daily Capacity, Gallons.
Tunkhannock	100,000
**Vandergrift	600,000
West Reading	250,000
Wilkes-Barre	14,000,000
*York	6,000,000
Rhode Island	
*Bristol-Warren	3,000,000
East Greenwich	1,000,000
**East Providence	2,000,000
Jamestown	500,000
Newport	6,000,000
Westerly	1,500,000
South Carolina	
Camden	350,000
*Charleston	6,000,000
Chester	300,000
Columbia	2,000,000
Union	500,000
Tennessee	
***Chattanooga	9,000,000
Clarksville	2,000,000
*Knoxville	5,000,000
Texas	
Beaumont	3,000,000
Graham	150,000
Greenville	500,000
La Grange	150,000
Virginia	
*Fort Myer	250,000
*Norfolk	8,000,000
Petersburg	1,500,000
Virginia Beach	100,000
Washington	
Waitsburg	500,000
West Virginia	
Benwood	500,000
Clarksburg	3,000,000
*Elm Grove	1,000,000
Fairmont	1,000,000

	Daily Capacity, Gallons.
Huntington	2,000,000
Morgantown	1,000,000
Wisconsin	
Merrill	1,000,000
Marinette	3,000,000
**Oshkosh	2,860,000
Stevens Point	500,000
Alberta, Canada	
*Medicine Hat	6,000,000
Edmonton	6,000,000
Manitoba	
Brandon	1,000,000
Ontario	
Arnprior	500,000
Chatham	1,000,000
Deseronto	500,000
Dunville	500,000
Renfrew	300,000
Smith's Falls	500,000
*St. Thomas	2,000,000
Thurso	100,000
Quebec	
Ahuntsic	500,000
Bordeaux	750,000
Buckingham	1,500,000
Fraserville	250,000
Longue Pointe	750,000
*Longueuil	1,750,000
Montreal	30,000,000
St. Hyacinthe	1,000,000
Verdun	1,000,000
New Brunswick	
*Fredericton	2,000,000
Mexico	
Chihuahua	1,750,000
San Luis Potosi	500,000
Isthmus of Panama	
Panama	1,500,000
*Colon	2,000,000
Corozal	1,000,000